

TO : R. L. Kirk, Director, Production Division

DATE: May 28 1953

FRC-41
8 of 19

FROM : S. H. Brown, Chief, Process Development Branch, Production Division

VJ.12-7

SPECIAL REREVIEW
FINAL DETERMINATION

VJ.12

SUBJECT: SUMMATION OF WASTE RESIDUE SAMPLING PROGRAM AT TONAWANDA AND ST. LOUIS

SPECIAL REREVIEW
FINAL DETERMINATION
UNCLASSIFIED

SYMBOL: PP;RSB;me

By:

Date:

S.H. Brown
11/6/53
P.F. Brown 10-20-50

MATERIALS - 13 Un.

I. Introduction

A sampling program for various waste residues located at LOOW and Haist sites (L-19, L-30, L-50, P-78, R-10 and R-10(Fe)) was conducted between December 1, 1952 and January 22, 1953. The purpose of the sampling program was to:

1. Provide the Chemical Construction Corporation with representative samples of these residues for development of a uranium recovery process under Contract AT(30-1)-1485.
2. Determine as accurately as possible the present uranium content of the various waste residues because past sampling activity by the Vitro Corporation of America provided results at considerable variance with NYOO S/F accountability records.

In addition, the AM-7 stored at St. Louis was grab sampled for the purpose of providing reasonable representative samples for the Chemical Construction Corporation's development studies.

R. S. Brief of the NYOO Process Development Branch, Production Division directly supervised the sampling activities utilizing Tonawanda Sub-Office personnel. Under the direction of J. J. Tregoning, NBL personnel analyzed 249 waste residue samples sent them. The results are presented in the appendix.

II. Summary

The table below compares the U₃O₈ S/F "book" value with the U₃O₈ found by the extensive sampling program undertaken. Composites of L-30, L-50 and R-10 were made up and then analyzed polarographically at NBL to determine cobalt, nickel and copper content.

Contents of Certain Waste Residues in Pounds

ORO 61477

Residue	S/F U ₃ O ₈	U ₃ O ₈ Found	Cobalt	Nickel	Copper
L-30	64,726	40,641	102,015	329,080	32,908
L-50	7,448	4,133	22,167	71,763	9,017
R-10	39,542	20,258	87,291	215,757	60,939
L-19	81,118	32,374	} Not determined by NBL		
P-78	16,527	8,367			
R-10(Fe)	3,039	1,130			
Totals	212,400	106,903			

~~RESTRICTED DATA~~

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Based on an estimated $\pm 20\%$ error in volume measurement, and a $\pm 5\%$ error in bulk density estimation, the 106,903 #U₃O₈ in the residues tabulated above were statistically analyzed and shown to have a reliability of from 93,000 #U₃O₈ minimum to 120,000 #U₃O₈ maximum.

The bulk samples sent to the Chemical Construction Corporation were analyzed for cobalt, nickel and copper values. The tabulation below indicates the quantities of these metals on the basis of the Chemico assays.

Chemico Results in Pounds

<u>Residue</u>	<u>Cobalt</u>	<u>Nickel</u>	<u>Copper</u>
L-30	128,341	361,988	27,972
L-50	33,813	81,903	none
R-10	105,408	247,050	75,762
L-19	none	none	36,700
P-78	none	none	6,153
R-10(Fe)	1,200	19,380	none
AM-7	<u>1,363,899</u>	<u>1,699,284</u>	<u>402,462</u>
Totals	1,632,661	2,409,605	549,049

The discrepancies in the cobalt, nickel and copper analyses for L-30, L-50 and R-10 will be checked by a trade of samples between Chemico and NBL. Note that the cobalt and nickel contents of AM-7 presented in the summary table in the appendix are based on past NBL analyses of this residue. The copper content of the AM-7 shown in the summary table was taken from the Chemico analyses.

The base metal values in AM-7, L-30 and L-50 are the property of the African Metals Corporation. African Metals is understood to have waived its rights on R-10 and R-10(Fe). L-19 and P-78 residues are completely owned by the Commission.

A summary tabulation of all the data obtained is appended as well as individual sample analyses and waste residue maps.

Tonawanda Residues

III. General Sampling and Analytical Procedures

A. General Sampling Technique

1. The waste residue to be sampled was divided into a number of equal volumes based on maps of the LOOW and Haist storage sites. Sampling locations were then selected at random with each sample representing one volume. Maps of the waste residue areas with the location of the sample points are appended. U₃O₈ analyses on a dry basis are indicated on each map for each sample location showing top, middle and bottom analyses, if applicable.

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Date: 1980
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2. Sample holes were dug with either a $3\frac{1}{2}$ " or 6" diameter auger (never using both for the same residue) and a 2" diameter pipe was used to complete the hole penetration if the hole wall collapsed when using the auger.
3. Samples were taken from the top and bottom halves of sample holes if the material was 4' or deeper; however, top, middle and bottom samples were taken from L-30 and L-50 because of their greater depth, 14' to 18'.
4. The analytical sample was removed from each auger scoop with a steel spatula or wooden stick and represented a vertical cross section of the residue. The material removed from each auger scoop had about the same volume, and a maximum of one quart represented each sampled section (viz., top or bottom half of the hole).
5. The material not required for the quart analytical sample was put in drums of suitable size. These drum samples were weighed and the bulk density of the contained residue was obtained.
6. One drum of each waste residue was sent to the Chemical Construction Corporation for process development activities. The analytical samples were sent to NBL for analysis of uranium and moisture content. Composites of L-30, L-50 and R-10 were also analyzed for cobalt, nickel and copper by NBL. The detailed sampling procedure used for each residue was presented in a memorandum from R. S. Brief to Files "Procedures for Sampling Waste Residues", dated January 21, 1953.

B. General Analytical Technique

A 0.2 gram sample of the waste residues was fused with Na_2CO_3 , then treated with $\text{HF} + \text{H}_2\text{SO}_4$ to complete dissolution of the entire sample. The resulting solution was heated to dryness, then to SO_3 fumes and then heated to a clear melt. The melt was dissolved with HNO_3 and then analyzed directly by the fluorimeter. If an assay of more than 0.7% U_3O_8 was attained, the sample was reanalyzed colorimetrically.

The L-30, L-50 and R-10 samples composites were analyzed for cobalt, nickel and copper by the polarograph.

IV. Determination of Waste Residue Content

To obtain the total uranium content of the various waste residues the following procedure was used:

1. By planimtering the appended maps, the surface area of each residue was determined. Mean depths were obtained from the maps and the bulk volume was then calculated.
2. The bulk density was calculated by obtaining the volume and net wet weight of the residues collected in the drums for Chemico's use.

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- The total wet weight of each residue was obtained simply by multiplying the bulk volume by the bulk density.
- The total uranium content of the various waste residues was obtained by using the total wet weight obtained from item 3, the per cent uranium and per cent solids obtained from New Brunswick analysis in the following formula:

$$\frac{(\text{wet weight}) \times (\% \text{ Uranium}) \times (\% \text{ Solids})}{10,000} = \text{Total Uranium Content}$$

- Cobalt, nickel and copper content were obtained in the same manner utilizing NBL analyses for these metals.
- A tabulation of the volumes and weights of the residues are listed below:

Wet Weights of Residues

	<u>Volume Calculated (ft.)</u>	<u>Bulk Density Calculated (lbs/cu.ft.)</u>	<u>Wet Weight Calculated (lb.)</u>	<u>Wet Weight(S/F) (lb.)</u>	<u>% Solids Found by NBL</u>
L-19	710,000	79.3	56,200,000	54,800,000	45.5
P-78	74,000	73.2	5,420,000	6,300,000	45.5
L-30	320,000	92.9	29,700,000	34,100,000	55.4
L-50	64,000	94.9	6,060,000	6,580,000	62.0
R-10	254,000	88.5	22,500,000	32,900,000	73.2
R-10(Fe)	8,000	78.5	628,000	1,000,000	47.8

St. Louis Residues

Raffinate cake (AM-7) stored at the Robertson site in St. Louis was sampled during the week of February 2, 1953 for the purpose of providing the Chemical Construction Corporation with bulk samples for process development studies. Two 30 gallon drums of AM-7, one representing shoveled grab samples from the surface of the piles and the other three augered samples (using a 3 1/2" auger). For details on this work see a memorandum from R. S. Brief to Files "Sampling AM-7", dated February 12, 1953.

AJ-4(U) and AJ-4(L), also stored at Robertson site, were not sampled at this time because AJ-4(U) can be easily processed in the MCW C-3 Plant and its grade is considered adequate for handling it in a waste residue recovery plant, regardless of the chemical technique used. The AJ-4(L) is a material of very low grade and the extreme marginal economics associated with it have eliminated it from consideration at this time.

Enclosure:
Summary Table, Waste Residue Analyses, Storage Area Maps

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- Cy. 1A - R. L. Kirk (w/enc. cy. 1A)
- 2A, 3A - S. H. Brown (w/enc. cy. 2A, 3A)
- 4A - F. M. Belmore (w/enc. cy. 4A)
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- 7A - J. A. Maffucci (w/enc. cy. 7A)
- 8A - C. J. Rodden, NBL (w/enc. cy. 8A)
- 9A - John Dasher, Chemico (w/enc. cy. 9A)
- 10A - Mail & Records (w/enc. cy. 10A) ✓

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SUMMATION TABLE

DATA REPORT NUMBER 1115
DATA REPORT DATE 22 OF JULY 1, 1980

Residue Code	Location	In thousand pounds		S.E.O.(Dry)	Ibs. E.O.	S/E E.O.	Dry E.O.	Dry S.E.	Dry S.O.	Ibs. Co.	Ibs. W.	Ibs. Co.
		Est. No.	Act. No.									
A-4 (X)	St. Louis	2278	2250	2.25	21927	21927						
A-4 (L)	St. Louis	12062	2278	0.14	12010	12010						
B-7	St. Louis	22222	24712	0.22	142222	142222	2.0	2.2	0.22	22222	142222	22222
L-20	LOCH	22700	12424	0.22	20241	24722	0.22	2.00	0.22	122212	22222	22222
L-20	LOCH	22222	2277	0.11	2122	2442	0.22	1.21	0.22	22227	21222	22227
B-20	LOCH	22222	12470	0.12	20222	22242	0.22	1.21	0.22	22221	21227	22222
B-19 (2)	LOCH	222	200	0.22	1122	2222	0.22	2.22	-	1222	12222	-
B-22	LOCH	222	222	0.22	2241	2241	.04	.12	0.22	122	222	222
B-22	LOCH	222	112	0.22	2212	2212						
B-22	LOCH	22	22	0.22	122	122						
B-22	LOCH	122	22	1.00	222	222						
B-72	St. Louis	2222	2222	0.22	2222	12227			0.22			2122
L-19	St. Louis	22227	12127	0.22	22222	21122			0.22			22722
B-22	St. Louis	2222	2221	0.22	222	2222						
TOTAL		222222	112222	0.222	222222	222212				112222	222222	222222
	St. Louis	122222	22222	0.222	212222	212222				222222	122222	222222
	St. Louis	22222	12222	0.222	21222	20222						22222
	LOCH	22221	22227	0.122	22221	22222				21222	22222	122222

Resampled Residues

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STATUS TABLE

Residue Code	Location	in thousand pounds		WASTE RESIDUE MATERIALS AS OF MAY 1, 1968							Lbs. Co.	Lbs. Hl.	Lbs. Cu.
		Wt. Wt.	Dry Wt.	% H ₂ O (Dry)	Lbs. H ₂ O	1/2 H ₂ O	Dry % Cu	Dry % Hl	Dry % Co				
A-4 (2)	St. Louis	2378	2280	2.28	81967	81967							
A-4 (1)	St. Louis	12082	8679	0.16	12010	12010							
A-7	St. Louis	88682	44718	0.38	148288	148288	2.0	2.7	0.80	89480	188480	40848	
L-20	LOOH	28700	18484	0.28	40841	84724	0.82	2.00	0.80	108018	228080	82808	
L-20	LOOH	8040	2787	0.12	6188	7444	0.88	1.81	0.24	22187	71788	8017	
R-10	LOOH	22800	18470	0.12	20288	28842	0.88	1.81	0.87	87281	218787	8028	
R-10 (P)	LOOH	828	300	0.24	1128	2028	0.60	6.46	-	1800	18300	-	
P-22	LOOH	878	482	0.64	2841	2841	.04	.18	0.20	180	832	488	
P-22	LOOH	380	118	3.08	2412	2412							
P-22	LOOH	80	28	0.88	178	178							
P-24	LOOH	148	74	1.00	740	740							
P-78	Missi	2480	2480	0.24	8287	18827			0.28				8188
L-19	Missi	28807	18207	0.28	82284	81118			0.28				28700
P-28	Missi	2882	2881	0.28	828	8028							
TOTALS		202822	112482	0.282	228384	484011				1107228	2281878	848841	
	St. Louis	104888	88827	0.388	812844	812844				894340	1881864	402462	
	Missi	28078	18248	0.228	41878	100741							42858
	LOOH	80081	27827	0.188	78421	121084				212883	284812	108226	

Resampled Residues

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